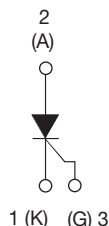


# Thyristor High Voltage, Phase Control SCR, 40 A



TO-247AC 3L



## FEATURES

- Designed and qualified according to JEDEC®-JESD 47
- Low  $I_{GT}$  parts available
- 125 °C max. operating junction temperature
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
**HALOGEN**  
**FREE**  
Available

## APPLICATIONS

- Typical usage is in input rectification crowbar (soft start) and AC switch motor control, UPS, welding and battery charge

## DESCRIPTION

The VS-40TPS... high voltage series of silicon controlled rectifiers are specifically designed for medium power switching and phase control applications. The glass passivation technology used has reliable operation up to 125 °C junction temperature.

## PRIMARY CHARACTERISTICS

|                       |                   |
|-----------------------|-------------------|
| $I_{T(AV)}$           | 35 A              |
| $V_{DRM}/V_{RRM}$     | 800 V, 1200 V     |
| $V_{TM}$              | 1.45 V            |
| $I_{GT}$              | 150 mA            |
| $T_J$                 | -40 °C to +125 °C |
| Package               | TO-247AC 3L       |
| Circuit configuration | Single SCR        |

## MAJOR RATINGS AND CHARACTERISTICS

| PARAMETER         | TEST CONDITIONS     | VALUES      | UNITS |
|-------------------|---------------------|-------------|-------|
| $I_{T(AV)}$       | Sinusoidal waveform | 35          | A     |
| $I_{RMS}$         |                     | 55          |       |
| $V_{RRM}/V_{DRM}$ |                     | 800 to 1200 | V     |
| $I_{TSM}$         |                     | 600         | A     |
| $V_T$             | 40 A, $T_J = 25$ °C | 1.45        | V     |
| dV/dt             |                     | 1000        | V/μs  |
| dI/dt             |                     | 100         | A/μs  |
| $T_J$             |                     | -40 to +125 | °C    |

## VOLTAGE RATINGS

| PART NUMBER    | $V_{RRM}/V_{DRM}$ ,<br>MAXIMUM REPETITIVE PEAK<br>AND OFF-STATE VOLTAGE<br>V | $V_{RSM}$ ,<br>MAXIMUM NON-REPETITIVE PEAK<br>REVERSE VOLTAGE<br>V | $I_{RRM}/I_{DRM}$<br>AT 125 °C<br>mA |
|----------------|------------------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------|
| VS-40TPS08A-M3 | 800                                                                          | 900                                                                | 10                                   |
| VS-40TPS08-M3  | 800                                                                          | 900                                                                |                                      |
| VS-40TPS12A-M3 | 1200                                                                         | 1300                                                               |                                      |
| VS-40TPS12-M3  | 1200                                                                         | 1300                                                               |                                      |



| ABSOLUTE MAXIMUM RATINGS                             |                   |                                                                                                     |                                       |        |               |        |
|------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------|--------|---------------|--------|
| PARAMETER                                            | SYMBOL            | TEST CONDITIONS                                                                                     |                                       | VALUES | UNITS         |        |
| Maximum average on-state current                     | $I_{T(AV)}$       | $T_C = 79\text{ }^{\circ}\text{C}$ , 180° conduction half sine wave                                 |                                       | 35     | A             |        |
| Maximum continuous RMS on-state current as AC switch | $I_{T(RMS)}$      |                                                                                                     |                                       | 55     |               |        |
| Maximum peak, one-cycle non-repetitive surge current | $I_{TSM}$         | 10 ms sine pulse, rated $V_{RRM}$ applied                                                           | Initial $T_J = T_J \text{ max.}$      | 500    |               | $A^2s$ |
|                                                      |                   | 10 ms sine pulse, no voltage reapplied                                                              |                                       | 600    |               |        |
| Maximum $I^2t$ for fusing                            | $I^2t$            | 10 ms sine pulse, rated $V_{RRM}$ applied                                                           |                                       | 1250   | $A^2s$        |        |
|                                                      |                   | 10 ms sine pulse, no voltage reapplied                                                              |                                       | 1760   |               |        |
| Maximum $I^2\sqrt{t}$ for fusing                     | $I^2\sqrt{t}$     | $t = 0.1\text{ ms to } 10\text{ ms}$ , no voltage reapplied                                         |                                       | 17 600 | $A^2\sqrt{s}$ |        |
| Low level value of threshold voltage                 | $V_{T(TO)1}$      | $T_J = 125\text{ }^{\circ}\text{C}$                                                                 |                                       | 1.02   | V             |        |
| High level value of threshold voltage                | $V_{T(TO)2}$      |                                                                                                     |                                       | 1.23   |               |        |
| Low level value of on-state slope resistance         | $r_{t1}$          |                                                                                                     |                                       | 9.74   | $m\Omega$     |        |
| High level value of on-state slope resistance        | $r_{t2}$          |                                                                                                     |                                       | 7.50   |               |        |
| Maximum peak on-state voltage                        | $V_{TM}$          | 110 A, $T_J = 25\text{ }^{\circ}\text{C}$                                                           |                                       | 1.85   | V             |        |
| Maximum rate of rise of turned-on current            | $dI/dt$           | $T_J = 25\text{ }^{\circ}\text{C}$                                                                  |                                       | 100    | A/ $\mu s$    |        |
| Maximum holding current                              | $I_H$             | Anode supply = 6 V, resistive load, initial $T_J = 1\text{ A}$ , $I_T = 25\text{ }^{\circ}\text{C}$ |                                       | 200    | mA            |        |
| Maximum latching current                             | $I_L$             | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^{\circ}\text{C}$                              |                                       | 300    |               |        |
| Maximum reverse and direct leakage current           | $I_{RRM}/I_{DRM}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                                                  | $V_R = \text{Rated } V_{RRM}/V_{DRM}$ | 0.5    |               |        |
|                                                      |                   | $T_J = 125\text{ }^{\circ}\text{C}$                                                                 |                                       | 10     |               |        |
| Maximum rate of rise of off-state voltage 40TPS12A   | dV/dt             | $T_J = T_J \text{ maximum, linear to } 80\text{ \% } V_{DRM}$ , $R_g - k = 100\text{ }\Omega$       |                                       | 500    | V/ $\mu s$    |        |
| Maximum rate of rise of off-state voltage 40TPS12    |                   |                                                                                                     |                                       | 1000   |               |        |

| TRIGGERING                                             |                    |                                                         |                                      |        |       |
|--------------------------------------------------------|--------------------|---------------------------------------------------------|--------------------------------------|--------|-------|
| PARAMETER                                              | SYMBOL             | TEST CONDITIONS                                         |                                      | VALUES | UNITS |
| Maximum peak gate power                                | P <sub>GM</sub>    |                                                         |                                      | 10     | W     |
| Maximum average gate power                             | P <sub>G(AV)</sub> |                                                         |                                      | 2.5    |       |
| Maximum peak gate current                              | I <sub>GM</sub>    |                                                         |                                      | 2.5    | A     |
| Maximum peak negative gate voltage                     | - V <sub>GM</sub>  |                                                         |                                      | 10     | V     |
| Maximum required DC gate voltage to trigger            | V <sub>GT</sub>    | T <sub>J</sub> = - 40 °C                                | Anode supply = 6 V<br>resistive load | 4.0    | V     |
|                                                        |                    | T <sub>J</sub> = 25 °C                                  |                                      | 2.5    |       |
|                                                        |                    | T <sub>J</sub> = 125 °C                                 |                                      | 1.7    |       |
| Maximum required DC gate current to trigger            | I <sub>GT</sub>    | T <sub>J</sub> = - 40 °C                                | Anode supply = 6 V<br>resistive load | 270    | mA    |
|                                                        |                    | T <sub>J</sub> = 25 °C                                  |                                      | 150    |       |
|                                                        |                    | T <sub>J</sub> = 125 °C                                 |                                      | 80     |       |
|                                                        |                    | T <sub>J</sub> = 25 °C, for 40TPS..APbF and 40TPS..A-M3 |                                      | 40     |       |
| Maximum DC gate voltage not to trigger<br>for 40TPS12  | V <sub>GD</sub>    | T <sub>J</sub> = 125 °C, V <sub>DRM</sub> = rated value |                                      | 0.25   | V     |
| Maximum DC gate current not to trigger<br>for 40TPS12  | I <sub>GD</sub>    |                                                         |                                      | 6      | mA    |
| Maximum DC gate voltage not to trigger<br>for 40TPS12A | V <sub>GD</sub>    | T <sub>J</sub> = 125 °C, V <sub>DRM</sub> = rated value |                                      | 0.15   | V     |
| Maximum DC gate current not to trigger<br>for 40TPS12A | I <sub>GD</sub>    |                                                         |                                      | 1      | mA    |



| THERMAL AND MECHANICAL SPECIFICATIONS           |                                   |                                      |             |                        |
|-------------------------------------------------|-----------------------------------|--------------------------------------|-------------|------------------------|
| PARAMETER                                       | SYMBOL                            | TEST CONDITIONS                      | VALUES      | UNITS                  |
| Maximum junction and storage temperature range  | T <sub>J</sub> , T <sub>Stg</sub> |                                      | -40 to +125 | °C                     |
| Maximum thermal resistance, junction to case    | R <sub>thJC</sub>                 | DC operation                         | 0.6         | °C/W                   |
| Maximum thermal resistance, junction to ambient | R <sub>thJA</sub>                 |                                      | 40          |                        |
| Maximum thermal resistance, case to heatsink    | R <sub>thCS</sub>                 | Mounting surface, smooth and greased | 0.2         |                        |
| Approximate weight                              |                                   |                                      | 6           | g                      |
|                                                 |                                   |                                      | 0.21        | oz.                    |
| Mounting torque                                 | minimum                           |                                      | 6 (5)       | kgf · cm<br>(lbf · in) |
|                                                 | maximum                           |                                      | 12 (10)     |                        |
| Marking device                                  |                                   | Case style TO-247AC 3L               | 40TPS08A    |                        |
|                                                 |                                   |                                      | 40TPS12A    |                        |
|                                                 |                                   |                                      | 40TPS08     |                        |
|                                                 |                                   |                                      | 40TPS12     |                        |

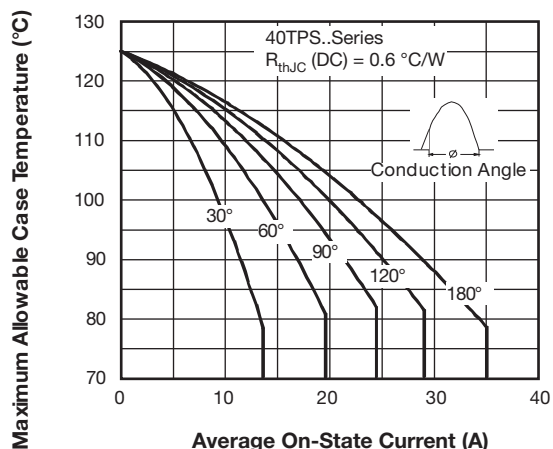


Fig. 1 - Current Rating Characteristics

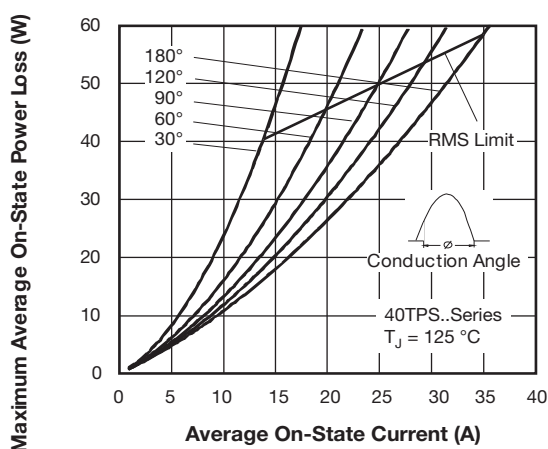


Fig. 3 - On-State Power Loss Characteristics

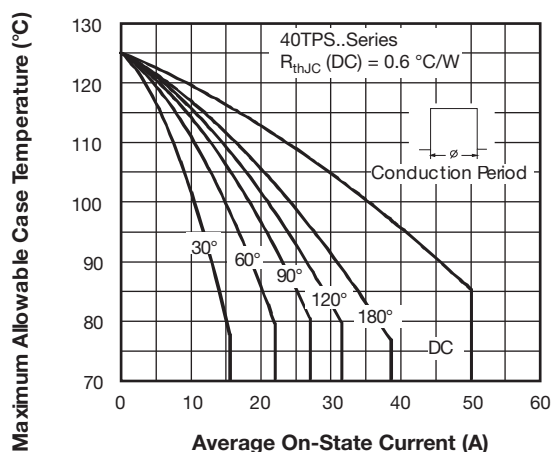


Fig. 2 - Current Rating Characteristics

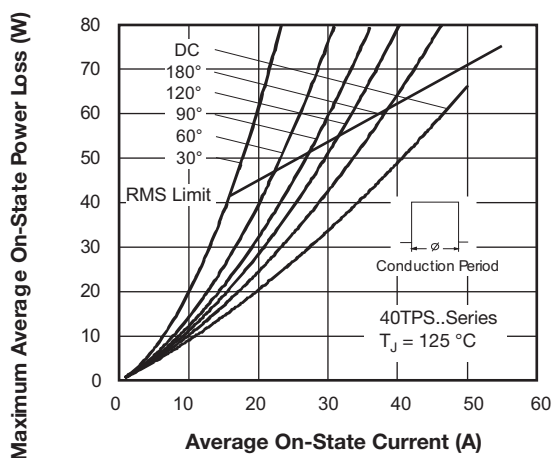


Fig. 4 - On-State Power Loss Characteristics

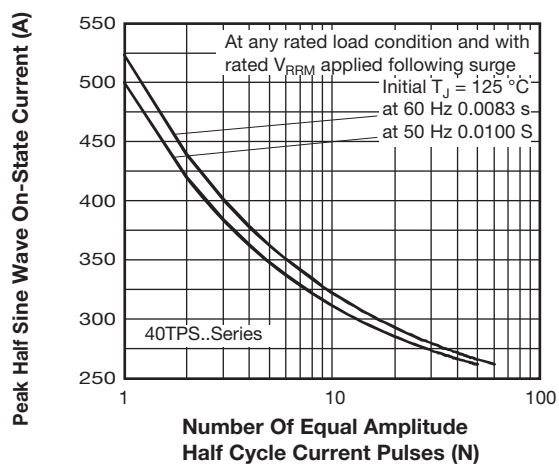


Fig. 5 - Maximum Non-Repetitive Surge Current

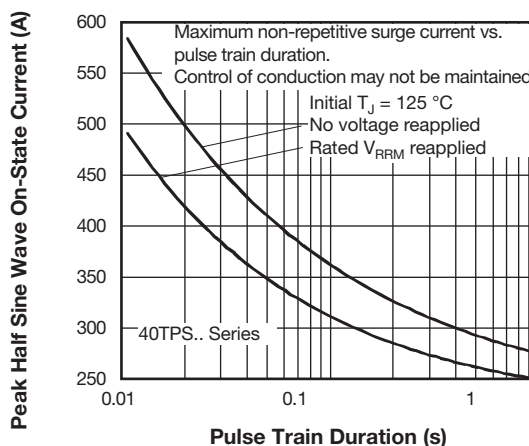


Fig. 6 - Maximum Non-Repetitive Surge Current

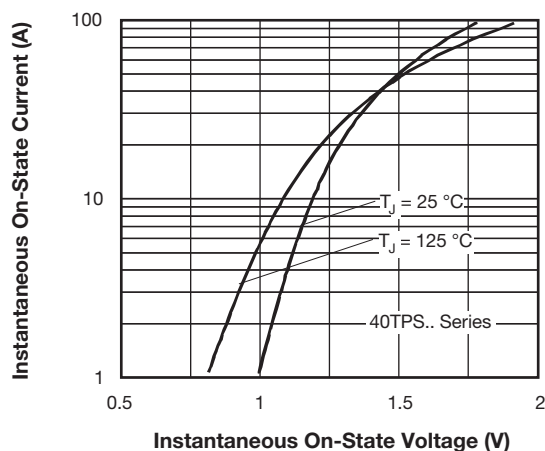


Fig. 7 - On-State Voltage Drop Characteristics

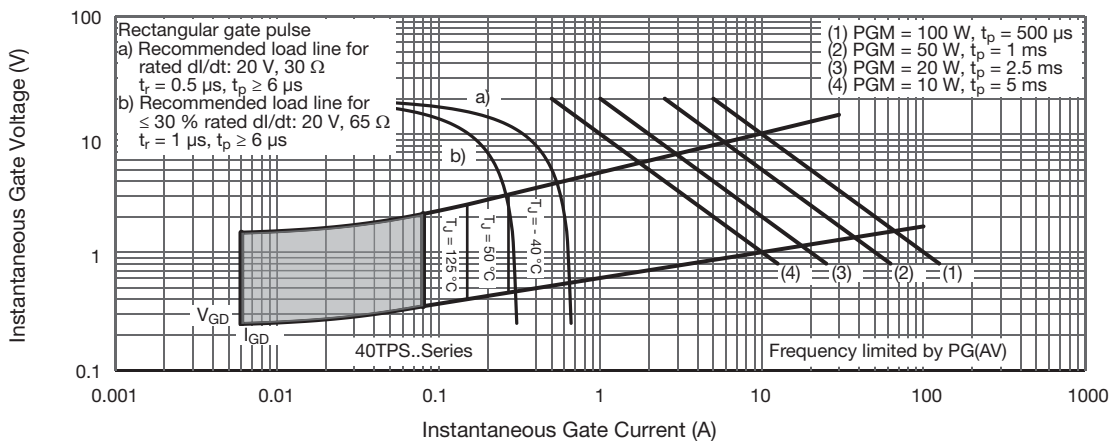


Fig. 8 - Gate Characteristics

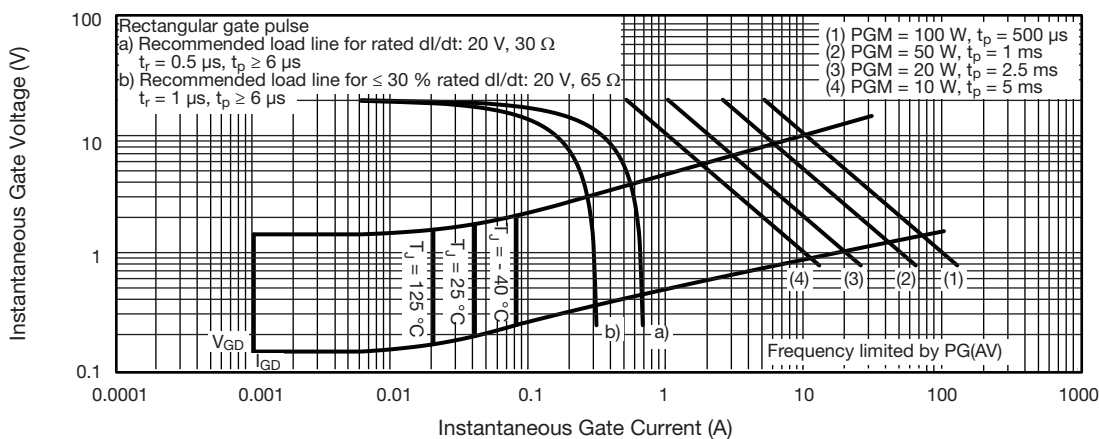
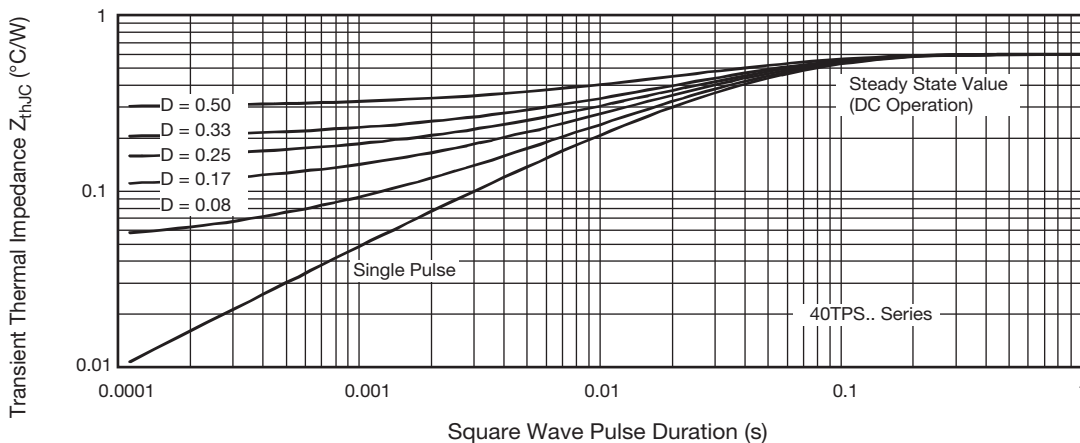


Fig. 9 - Gate Characteristics, 40TPS..A Series


Fig. 10 - Thermal Impedance  $Z_{thJC}$  Characteristics

**ORDERING INFORMATION TABLE**

|             |            |           |          |          |          |           |          |            |
|-------------|------------|-----------|----------|----------|----------|-----------|----------|------------|
| Device code | <b>VS-</b> | <b>40</b> | <b>T</b> | <b>P</b> | <b>S</b> | <b>12</b> | <b>A</b> | <b>-M3</b> |
|             | ①          | ②         | ③        | ④        | ⑤        | ⑥         | ⑦        | ⑧          |

- |          |   |                                                                                             |
|----------|---|---------------------------------------------------------------------------------------------|
| <b>1</b> | - | Vishay Semiconductors product                                                               |
| <b>2</b> | - | Current rating (40 = 40 A)                                                                  |
| <b>3</b> | - | Circuit configuration:<br>T = thyristor                                                     |
| <b>4</b> | - | Package:<br>P = TO-247AC 3L                                                                 |
| <b>5</b> | - | Type of silicon:<br>S = standard recovery rectifier                                         |
| <b>6</b> | - | Voltage ratings                                                                             |
| <b>7</b> | - | • A = low $I_{GT}$ selection 40 mA maximum<br>• None = standard $I_{gt}$ selection          |
| <b>8</b> | - | Environmental digit:<br>-M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free |

|                           |
|---------------------------|
| 08 = 800 V<br>12 = 1200 V |
|---------------------------|

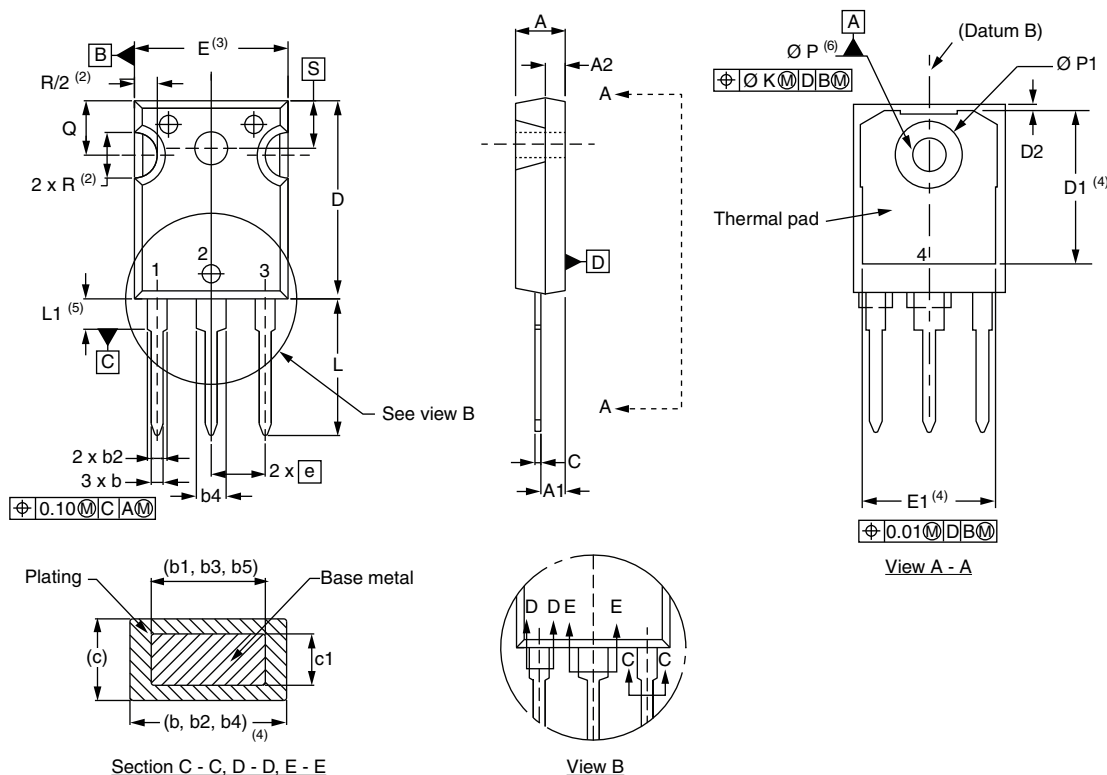
| <b>ORDERING INFORMATION</b> (Example) |                  |                        |                          |
|---------------------------------------|------------------|------------------------|--------------------------|
| PREFERRED P/N                         | QUANTITY PER T/R | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION    |
| VS-40TPS08A-M3                        | 25               | 500                    | Antistatic plastic tubes |
| VS-40TPS08-M3                         | 25               | 500                    | Antistatic plastic tubes |
| VS-40TPS12A-M3                        | 25               | 500                    | Antistatic plastic tubes |
| VS-40TPS12-M3                         | 25               | 500                    | Antistatic plastic tubes |

| <b>LINKS TO RELATED DOCUMENTS</b> |                                                                        |
|-----------------------------------|------------------------------------------------------------------------|
| Dimensions                        | <a href="http://www.vishay.com/doc?96138">www.vishay.com/doc?96138</a> |
| Part marking information          | <a href="http://www.vishay.com/doc?95007">www.vishay.com/doc?95007</a> |



## TO-247AC 3L

DIMENSIONS in millimeters and inches



| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| A      | 4.65        | 5.31  | 0.183  | 0.209 |       |
| A1     | 2.21        | 2.59  | 0.087  | 0.102 |       |
| A2     | 1.17        | 1.37  | 0.046  | 0.054 |       |
| b      | 0.99        | 1.40  | 0.039  | 0.055 |       |
| b1     | 0.99        | 1.35  | 0.039  | 0.053 |       |
| b2     | 1.65        | 2.39  | 0.065  | 0.094 |       |
| b3     | 1.65        | 2.34  | 0.065  | 0.092 |       |
| b4     | 2.59        | 3.43  | 0.102  | 0.135 |       |
| b5     | 2.59        | 3.38  | 0.102  | 0.133 |       |
| c      | 0.38        | 0.89  | 0.015  | 0.035 |       |
| c1     | 0.38        | 0.84  | 0.015  | 0.033 |       |
| D      | 19.71       | 20.70 | 0.776  | 0.815 | 3     |
| D1     | 13.08       | -     | 0.515  | -     | 4     |

| SYMBOL | MILLIMETERS |       | INCHES    |       | NOTES |
|--------|-------------|-------|-----------|-------|-------|
|        | MIN.        | MAX.  | MIN.      | MAX.  |       |
| D2     | 0.51        | 1.35  | 0.020     | 0.053 |       |
| E      | 15.29       | 15.87 | 0.602     | 0.625 | 3     |
| E1     | 13.46       | -     | 0.53      | -     |       |
| e      | 5.46 BSC    |       | 0.215 BSC |       |       |
| Ø K    | 0.254       |       | 0.010     |       |       |
| L      | 14.20       | 16.10 | 0.559     | 0.634 |       |
| L1     | 3.71        | 4.29  | 0.146     | 0.169 |       |
| Ø P    | 3.56        | 3.66  | 0.14      | 0.144 |       |
| Ø P1   | -           | 7.39  | -         | 0.291 |       |
| Q      | 5.31        | 5.69  | 0.209     | 0.224 |       |
| R      | 4.52        | 5.49  | 0.178     | 0.216 |       |
| S      | 5.51 BSC    |       | 0.217 BSC |       |       |

## Notes

- (1) Dimensioning and tolerancing per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- (4) Thermal pad contour optional with dimensions D1 and E1
- (5) Lead finish uncontrolled in L1
- (6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- (7) Outline conforms to JEDEC® outline TO-247 with exception of dimension Q



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